

PATENT COOPERATION TREATY

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PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C. 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 28 July 2000 (28.07.00)	in its capacity as elected Office
International application No. PCT/IL98/00342	Applicant's or agent's file reference 669/98
International filing date (day/month/year) 23 July 1998 (23.07.98)	Priority date (day/month/year) 24 July 1997 (24.07.97)
Applicant	
BAR NATAN, Nir et al	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

23 February 1999 (23.02.99)

in a notice effecting later election filed with the International Bureau on:

2. The election was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Beatriz Morariu</p> <p>Telephone No.: (41-22) 338.83.38</p>
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PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

To:

SELIGSOHN & GABRIELI
 P.O. Box 1426
 61013 Tel Aviv
 ISRAËL

RECEIVED

07 2000

Technology Center 2600

Date of mailing (day/month/year)

28 July 2000 (28.07.00)

Applicant's or agent's file reference

669/98

IMPORTANT NOTIFICATION

International application No.

PCT/IL98/00342

International filing date (day/month/year)

23 July 1998 (23.07.98)

1. The following indications appeared on record concerning:

the applicant the inventor the agent the common representative

Name and Address

GRAPHITECH LTD.
 Herzl Street 25
 51364 Bnei-Braq
 Israel

State of Nationality

IL

State of Residence

IL

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person the name the address the nationality the residence

Name and Address

WONDERNET LTD.
 111 Cahanman Street
 51553 Benei Brak
 Israel

State of Nationality

IL

State of Residence

IL

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

 the receiving Office the designated Offices concerned the International Searching Authority the elected Offices concerned the International Preliminary Examining Authority other:

The International Bureau of WIPO
 34, chemin des Colombettes
 1211 Geneva 20, Switzerland

Authorized officer

Beatriz Morariu

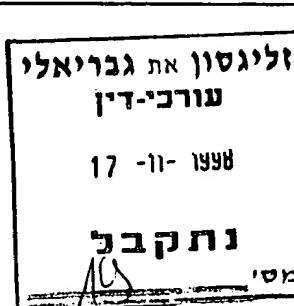
Facsimile No.: (41-22) 740.14.35

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: SELIGSOHN & GABRIELI
POB 1426
TEL AVIV 61013 ISRAEL



PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

Date of Mailing
(day/month/year)

03 NOV 1998

Applicant's or agent's file reference 669/98	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/IL98/00342	International filing date (day/month/year) 23 JULY 1998
Applicant GRAPHITECH LTD.	

1. The applicant is hereby notified that the international search report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the international search report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in rules 90 bis 1 and 90 bis 3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer SALVATORE CANGIALOSI <i>Joni Bell</i> Telephone No. (703) 305-1837
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 669/98	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5
International application No. PCT/IL98/00342	International filing date (day/month/year) 23 JULY 1998	(Earliest) Priority Date 24 JULY 1997
Applicant GRAPHITECH LTD.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Certain claims were found unsearchable (See Box I).
2. Unity of invention is lacking (See Box II).
3. The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
 - filed with the international application.
 - furnished by the applicant separately from the international application,
 - but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
 - transcribed by this Authority.
4. With regard to the title, the text is approved as submitted by the applicant.
 - the text has been established by this Authority to read as follows:
5. With regard to the abstract,
 - the text is approved as submitted by the applicant.
 - the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. The figure of the drawings to be published with the abstract is:

Figure No. 1 as suggested by the applicant. None of the figures.

because the applicant failed to suggest a figure.

because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL98/00342

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

The technical features mentioned in the abstract do not include a reference sign between parentheses (PCT Rule 8.1(d)).

NEW ABSTRACT

A system and method for authenticating a signature, the system including a digitizer (10) and associated electronic pen(12), a dynamic identification unit (14) for receiving data from the digitizer (10) produced during the signature by the electronic pen (12) on the digitizer (10), calculating signature parameters and permitted variations from the data, and generating a reference record (15) therefrom, a comparator (17) for comparing the received parameters produced during signature with the reference record (15), and apparatus for providing and accept or reject response in accordance with the output of the comparator (17).

P.C.T 7/99

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To: SELIGSOHN & GABRIELI
POB 1426
TEL AVIV 61013 ISRAEL

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of Mailing
(day/month/year)

09 JUN 1999

Applicant's or agent's file reference
669/98

REPLY DUE

within TWO months
from the above date of mailing

International application No.
PCT/IL98/00342

International filing date (day/month/year)
23 JULY 1998

Priority date (day/month/year)
24 JULY 1997

International Patent Classification (IPC) or both national classification and IPC
IPC(6): HO4L 9/00 and US Cl.: 380/23

Applicant
GRAPHITECH LTD.

1. This written opinion is the first (first, etc.) drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
 - I Basis of the opinion
 - II Priority
 - III Non-establishment of opinion with regard to novelty, inventive step or industrial applicability
 - IV Lack of unity of invention
 - V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI Certain documents cited
 - VII Certain defects in the international application
 - VIII Certain observations on the international application
3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. ~~The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).~~

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 24 NOVEMBER 1999

Name and mailing address of the IPEA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Authorized officer

SALVATORE CANALALOSI

Facsimile No. (703) 305-3230

Telephone No. (703) 305-1837

WRITTEN OPINION

International application No.

PCT/IL98/00342

I. Basis of the opinion

1. This opinion has been drawn on the basis of (*Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"*):

the international application as originally filed.

the description, pages 1-10, as originally filed.

pages NONE, filed with the demand.

pages NONE, filed with the letter of _____

the claims, Nos. 1-12, as originally filed.

Nos. NONE, as amended under Article 19.

Nos. NONE, filed with the demand.

Nos. NONE, filed with the letter of _____

the drawings, sheets/fig 1-5, as originally filed.

sheets/fig NONE, filed with the demand.

sheets/fig NONE, filed with the letter of _____

2. The amendments have resulted in the cancellation of:

the description, pages NONE

the claims, Nos. NONE

the drawings, sheets/fig NONE

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the ~~Supplemental Box~~ Additional observations below (Rule 70.2(c)).

4. Additional observations, if necessary:

NONE

WRITTEN OPINION

International application No.

PCT/IL98/00342

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims <u>1-12</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-12</u>	NO
Industrial Applicability (IA)	Claims <u>1-12</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-12 lack an inventive step under PCT Article 33(3) as being obvious over HARAGUCHI OR WAGNER et al in view of either KAPP et al or SMITHIES. Each of HARAGUCHI or WAGNER et al describe a method and system for authenticating signatures including digitization and comparison. The claims differ from the above by the provision of encryption. Either KAPP et al or SMITHIES show the use of encryption in signature authentication. Therefore to employ the process and system of either KAPP et al or SMITHIES in a similar process and system of HARAGUCHI or WAGNER et al would have been obvious to the routineer in the art and fairly taught by the proposed combination.

----- NEW CITATIONS -----

NONE

WRITTEN OPINION

International application No.

PCT/IL98/00342

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

TIME LIMIT:

The time limit set for response to a Written Opinion may not be extended. 37 CFR 1.484(d). Any response received after the expiration of the time limit set in the Written Opinion will not be considered in preparing the International Preliminary Examination Report.

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are component, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ US

CHAPTER II

PCT

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND
------------------------	------------------------------

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference 669/98
International application No. PCT/IL98/00342	International filing date (day/month/year) 23.07.1998	(Earliest) Priority date (day/month/year) 24.07.1997
Title of invention SYSTEM AND METHOD FOR AUTHENTICATING SIGNATURES		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) GraphiTech Ltd. 25 Herzl Street Bnei-Braq 51364 Israel		Telephone No.: +972-3-677-3844
		Facsimile No.: +972-3-677-3842
		Teleprinter No.:
State (that is, country) of nationality: IL	State (that is, country) of residence: IL	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) BAR-NATAN, Nir 50 Harei Yehudah Street, Apt. 5 Ganei Tikvah 55900 Israel		
State (that is, country) of nationality: IL	State (that is, country) of residence: IL	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) BASSAN, Jonathan 2 Hanoter Street Ramat Hasharon 47210 Israel		
State (that is, country) of nationality: IL	State (that is, country) of residence: IL	
<input checked="" type="checkbox"/> Further applicants are indicated on a continuation sheet.		

Continuation of Box. No. II APPLICANT(S)*If none of the following sub-boxes is used, this sheet should not be included in the demand.*

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

GROZOVIK, Oren
12 Lamdan Street
Tel Aviv 69414
Israel

State (that is, country) of nationality: **IL**State (that is, country) of residence: **IL**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

WAISEL, Shai
6 Hazait Street
Petach Tikvah 49214
Israel

State (that is, country) of nationality: **IL**State (that is, country) of residence: **IL**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

 Further applicants are indicated on another continuation sheet

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is agent common representative

and has been appointed earlier and represents the applicant(s) also for international preliminary examination.

is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: (family name following be given name: for a legal entity, full official designation.
The address must include postal code and name of country.)

Telephone No.:
(972)-3-566-1446

Seligsohn & Gabrieli
P. O. Box 1426
Tel-Aviv, 61013
ISRAEL

Facsimile No.:
(972)-3-560-8458

Teleprinter No.:

Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION**Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

the international application as originally filed.

the description as originally filed
 as amended under Article 34

the claims as originally filed
 as amended under Article 19 (together with any accompanying statement)
 as amended under Article 34

the drawings as originally filed
 as amended under Article 34

2. The applicant wishes any amendment to the claims made under Article 19 to be considered as reversed.

3. The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). (This check-box may be marked only where the time limit under Article 19 has not yet expired.)

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examination Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purpose of international preliminary examination: English

which is the language in which the international application was filed.

which is the language of a translation furnished for the purposes of international search.

which is the language publication of the international application.

which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby elects all eligible States (that is, all States which have been designated and which are bound by Chapter II of the PCT) excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

1. translation of international application	:	sheets
2. amendments under Article 34	:	sheets
3. copy (or, where required, translation) of amendments under Article 19	:	sheets
4. copy (or, where required, translation) of statement under Article 19	:	sheets
5. letter	:	1 sheets
6. other (specify):	:	sheets

For International Preliminary Examination Authority use only

received	not received
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

1. <input checked="" type="checkbox"/> fee calculation sheet	4. <input type="checkbox"/> statement explaining lack of signature
2. <input type="checkbox"/> separate signed power of attorney	5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form
3. <input checked="" type="checkbox"/> copy of general power of attorney	6. <input type="checkbox"/> other (specify):

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

Deborah GADOR, Seligsohn & Gabrieli

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:	
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):	
3. <input type="checkbox"/> The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply	<input type="checkbox"/> The applicant has been informed accordingly
4. <input type="checkbox"/> The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.	
5. <input type="checkbox"/> Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.	

For International Bureau use only

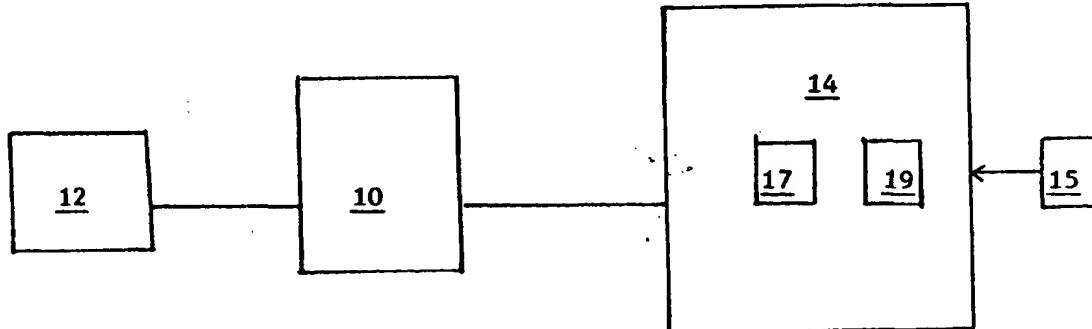
Demand received from IPEA on:



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04L 9/00		A1	(11) International Publication Number: WO 99/05816 (43) International Publication Date: 4 February 1999 (04.02.99)
(21) International Application Number: PCT/IL98/00342 (22) International Filing Date: 23 July 1998 (23.07.98)		(81) Designated States: JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(30) Priority Data: 121389 24 July 1997 (24.07.97) IL		Published <i>With international search report.</i>	
(71) Applicant (for all designated States except US): GRAPHITECH LTD. [IL/IL]; Herzl Street 25, 51364 Bnei-Braq (IL).			
(72) Inventors; and (75) Inventors/Applicants (for US only): BAR NATAN, Nir [IL/IL]; Apartment 5, Harei Yehudah Street 50, 55900 Ganei Tikvah (IL). BASSAN, Jonathan [IL/IL]; Hanoter Street 2, 47210 Ramat Hasharon (IL). GROZOVIK, Oren [IL/IL]; Lamdan Street 12, 69414 Tel Aviv (IL). WAISEL, Shai [IL/IL]; Hazait Street 6, 49214 Petach Tikvah (IL).			
(74) Agent: SELIGSOHN & GABRIELI; P.O. Box 1426, 61013 Tel Aviv (IL).			

(54) Title: SYSTEM AND METHOD FOR AUTHENTICATING SIGNATURES



(57) Abstract

A system and method for authenticating a signature, the system including a digitizer (10) and associated electronic pen (12), a dynamic identification unit (14) for receiving data from the digitizer (10) produced during the signature by the electronic pen (12) on the digitizer (10), calculating signature parameters and permitted variations from the data, and generating a reference record (15) therefrom, a comparator (17) for comparing the received parameters produced during signature with the reference record (15), and apparatus for providing an accept or reject response in accordance with the output of the comparator (17).

420 Rec'd PCT/PTO 24 JAN 2000

SYSTEM AND METHOD FOR AUTHENTICATING SIGNATURES

FIELD OF THE INVENTION

The present invention relates to a system and method for authenticating signatures in general and, in particular, to a 5 system and method for authenticating signatures transmitted over digital communication lines.

BACKGROUND OF THE INVENTION

In the field of computer graphics, it is known to use a 10 digitizer to convert graphical data into electronic data for a computer. A user draws with an electronic pen on the digitizer tablet, and the digitizer converts the graphical data to electric signals. Such digitizers are used today for inputting data to computers, similar to a mouse.

15 There are many occasions in which it is necessary to authenticate the signature of a person signing a document in order to ensure that the signatory is indeed the person whose name is being signed. One particular application is the field of credit cards, wherein sums of money change hands in 20 reliance on the signature of the card holder. In the event that a card is stolen, a person who can forge the cardholder's signature can charge items against the cardholder's bank account. Similarly, when purchases are made over the telephone, the number and expiration date of the 25 card are read to the vendor, but there is no way to verify whether the caller is an authorized user of the card.

This problem has reached new heights with the advent of the Internet, where sales are transacted by means of transmitting the number and expiration date of the credit 30 card only, without any means of verifying the origin of the purchase. Since these communication lines are open, it is easy for a hacker to determine the number and expiration date of someone else's credit card which were transmitted over his modem, and to use that credit card for unauthorized 35 purchases.

Authentication of signatures by means of a graphical image (or bitmap) is not a solution because a photocopy of the signature looks authentic and cannot be detected.

Accordingly, there is a long felt need for and it would 5 be very desirable to have a method of authenticating the signature of a person, particularly a person using a credit card, both in a conventional sales transaction in a store, and over transmission lines, such as the Internet.

10

SUMMARY OF THE INVENTION

According to the present invention, there is provided a system for authenticating a signature including a digitizer, an electronic pen, a dynamic identification unit for measuring vectors produced during signature by the electronic 15 pen on the digitizer, and a comparator for comparing the vectors produced during signature with a reference signature.

According to a preferred embodiment, the system also includes an encryptor for encrypting a signature record and a decoder for decoding the encrypted signature record.

20

According to another preferred embodiment, the reference signature record is stored on an IC (integrated chip) card.

In accordance with the present invention, there is also provided a method of authenticating a signature including the steps of

25

providing a reference signature record,
signing with an electronic pen on a digitizer tablet,
calculating parameters from data produced during signing on the digitizer tablet;

30

comparing the parameters produced during signature with a reference signature record; and

providing an accept or reject response in accordance with results of the comparison.

According to a preferred embodiment, the method also includes the steps of encrypting the calculated parameters

with a encryption key, and decrypting the encrypted data before comparing the parameters.

Further according to a preferred embodiment, the method includes the step of transmitting the calculated parameters 5 over a transmission line to a remote location before the step of comparing.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be further understood and 10 appreciated from the following detailed description taken in conjunction with the drawings in which:

Fig. 1 is a schematic illustration of a signature authentication system according to one embodiment of the present invention;

15 Fig. 2 is a schematic illustration of a signature authentication system according to one embodiment of the present invention;

Fig. 3 is a flow chart of a method of providing a reference signature according to the invention;

20 Fig. 4 is a flow chart of a method of authenticating a signature;

Fig. 5 is a detail of a method of comparing the signature in the method of Fig. 4; and

25 Fig. 6 is a flow chart of a method of updating a reference signature.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a system and method for authenticating signatures, the system and method being 30 suitable also for authenticating signatures transmitted over communication lines. The present invention uses signature vector recognition and is based on the use of a digitizer together with software in a dynamic identification unit which calculates parameters based on data produced during signature 35 by the electronic pen on the digitizer tablet. These

parameters, which are unique to each person when he signs his own name, are compared with the parameters in a reference signature record, or personal signature profile, which is based on data produced during a number of signatures, to 5 determine whether the signature is authentic (i.e., signature by the authorized signatory) or forged.

For purposes of the present invention, a digitizer refers to any device which converts a location on an X,Y tablet, possibly with the angle of the pen and the pressure 10 on the pen, to a numerical value, and an electronic pen is any device by which a person can write or sign on a digitizer tablet such that parameters of his handwriting can be detected by the digitizer. It will be appreciated that the system can be used to authenticate the handwriting of any 15 predetermined word or words for which a reference record is made. Since the most common words used to identify a person are his signature, the present application refers to signatures, by way of non-limiting example, only.

It will be appreciated that there are many instances 20 when it is desirable to authenticate the signature of a signatory, both in legal and business matters. The invention will be described hereinbelow with relation to credit cards, for which it is particularly suitable, by way of example only, but those skilled in the art will appreciate that it 25 can also be applied in any other instance of signature verification where the system components can be made available.

When transmitting the signature over transmission lines for acceptance, as by a bank or credit card company, 30 additional security can be provided by encrypting the signature with a secret key, known only to the signatory and the bank, which cannot be determined by downloading the data containing the signature signals from the transmission line.

Referring now to Fig. 1, there is shown a schematic 35 illustration of a system for authenticating a signature

constructed and operative in accordance with one embodiment of the invention. The system includes a digitizer 10 with an associated electronic pen 12 coupled to a computer 14 for authenticating a signature at the time and place of 5 signature. This system is particularly suitable for point of sale use. Digitizer 10 can be any conventional digitizer, such as a Wacom Digitizer, manufactured by Wacom Co. Ltd., Japan.

The signatory carries an Integrated Chip (IC) card, or 10 smart card 15 on which is stored a reference signature record, or personal signature profile, for the signatory. Computer 14 includes a comparator 17, which compares the signature to be authenticated with the reference signature record stored on IC card 15. If the signature is within 15 predefined tolerances of the reference signature, comparator 17 sends an accept signal to computer 14. If the signature is not within the predefined tolerances of the reference signature, comparator 17 sends a reject signal to computer 14.

20 Referring now to Fig. 2, there is shown a schematic illustration of a system for authenticating a signature constructed and operative in accordance with an alternative embodiment of the invention. The system includes a digitizer 10' with an associated electronic pen 12' coupled to a 25 computer 14' having a modem (not shown) for transmitting data from computer 14' to a remote location 16, generally a bank or credit card company in the present example.

At remote location 16, the data is received by a dynamic 30 identification unit 20 arranged to receive the data produced during signature by the electronic pen on the digitizer tablet and calculate therefrom a table of parameters which constitutes a signature record. The result is provided to a comparator 22 which compares the signature to be 35 authenticated with a reference signature record, or personal signature profile, stored in its memory 24. If the signature

is within predefined tolerances of the reference signature, comparator 22 sends an accept signal to computer 14'. If the signature is not within the predefined tolerances of the reference signature, comparator 22 sends a reject signal to 5 computer 14'.

Operation of the system of the invention is as follows. First, a reference signature record, or personal signature profile, must be provided for the bank or credit card company or other body which must accept or reject the signature, as 10 shown in Fig. 2. This is done at the time of opening an account or requesting a credit card. The user signs his name on a digitizer tablet coupled to the computer of the credit card company. The pen position over the tablet is recorded by the computer to produce vectors, and a mathematical analysis 15 is performed to learn the following parameters at any given time during the signature process:

pen position (X, Y coordinates) over the tablet;
sequences of drawing: number of letters, relative position, and time to draw;
20 acceleration and deceleration during signature;
direction changes.

Optionally the computer can also calculate pen tilt relative to the tablet and pen pressure, if the digitizer used is capable of providing this data. The digitizer data of the 25 signature are input 30 to the dynamic identification unit in the computer. The dynamic identification unit records 32 the parameters of the signature. The recorded parameters are arranged 34 in a table of parameters. This process is repeated 36 a predetermined number of times, for example 30 between 5 and 10, so as to permit the dynamic identification unit to calculate the tolerances 38 associated with the variations in the individual's signature, which is never identical. It will be appreciated that the range of acceptable variations in a personal signature profile will 35 vary from person to person. Once the parameter table and

tolerances have been determined, these are stored in the computer memory for later reference as the reference signature record. It will be appreciated that, preferably, the personal signature profile consists of an array of 5 parameters and logical tolerances or permitted variations, not an "average" signature.

A personal ID code is also recorded 39 together with the signature vector table. This personal ID code serves as an encryption key to provide additional security for signature 10 data transmitted over transmission lines. This encryption key can be any string selected by the user which is known only to him and the credit card company. While the password selected by the credit card company, which is used in cash machines, etc. in conventional credit card authentication systems, can 15 be used as the encryption key, it is preferable to select a key which does not appear on the card. One example of a suitable encryption key is the user's birthdate.

It is a particular feature of the invention that the dynamic identification unit will recognize a person's 20 signature even if it is signed upside down (i.e., where the cardholder is in front of a counter) or rotated to any other angle, where the signature is smaller or larger in size, or slightly different in details.

At the time of making a credit card purchase, the 25 purchaser's signature is authenticated as follows, as shown in Fig. 3. The customer signs with an electronic pen on a digitizer tablet in the store or on the digitizer tablet coupled to his home computer. The record of the signature is received 40 by the credit card company. The dynamic 30 identification unit retrieves 42 the reference signature record of the cardholder. It may also retrieve 44 the personal ID code of the cardholder from the company computer if the signature is encrypted with the personal ID code. Generally this is necessary when making purchases other than 35 at point of sale. If the record of the signature was

encrypted (described in detail hereinbelow) the record is now decrypted 46. If no recognizable signature record is received 48, the signature is rejected.

5 If the decryption results in a recognizable signature record, or if the signature record was not encrypted, the dynamic identification unit proceeds to identify the signature 50, as shown in detail in Fig. 4. The dynamic identification unit traces 52 the vector lines in the signature record and fills a parameter table 54 with the 10 various parameters. The parameter table of the signature record is compared 56 with the reference parameter table stored in the computer memory.

15 Parameters for comparison are selected, for example, from the characteristics listed above. Any or all may be selected for use by the programmer. For example, the comparator can determine whether there is a significant difference in time of writing the signature 58, which could indicate copying rather than an authentic signature. It can determine whether there is a difference in the number of 20 vectors 60, i.e., whether a letter has been added or omitted. It can look for a change in the angle of the pen 62. It can determine whether there is a change in the relative direction of the signature 63. And it can determine whether there are differences in pressure during signing 64. If any of the 25 examined parameters is significantly different, i.e., outside the range of tolerances 66 (Fig. 3), the signature will be rejected. If the signature record meets all the characteristics of the reference signature record, the signature will be authenticated and accepted. An indication 30 of acceptance is then sent to the point of purchase.

When making transactions at the point of sale, generally the physical lines are sufficiently secure that no encryption is required, although it can be used, if desired. However, for transactions over the Internet, encryption is recommended 35 to prevent theft of the credit card details. In this case,

the Web surfer will have his own digitizer tablet coupled to his computer. After typing in the credit card number, as in conventional credit card purchases over the net, a signature authentication software driver will pop an input window to 5 the cardholder's screen. The cardholder will type his personal ID code and then sign his name on the digitizer tablet. The vectors produced during signature on the digitizer tablet are calculated and the software encrypts the signature data using the personal ID code as the encryption 10 key, as known.

The encrypted signature record is sent to the vendor, which may be a site on the Internet. The vendor forwards the signature record, as is, to the credit card company for authentication of the signature. When the encrypted signature 15 record reaches the credit card company, it is authenticated as described above with reference to Figs. 3 and 4. When the reference signature data of the cardholder is retrieved, the encryption key is also retrieved, permitting the dynamic identification unit to decrypt the signature record and 20 compare it with the reference signature. In accordance with the results of the comparison, the credit card company will notify the vendor that the signature is accepted or rejected.

Preferably, the authenticating computer will include means for detecting hacking. For example, if two identical 25 signatures are received, one after another, the computer is preferably programmed to reject the second signature, even if it falls within the personal signature profile. This is because, in real life, no one signs his or her name exactly the same way twice in a row.

30 On the other hand, over time, a person's signature tends to change. Therefore, according to a preferred embodiment of the invention, updating means is provided for changing the personal signature profile or reference signature record, in accordance with perceived, consistent changes in the

signature. A flow chart of one example of suitable software for accomplishing this updating is illustrated in Fig. 5.

In Fig. 5, the comparator receives the signature for authentication and compares it with the personal signature profile (block 70). If the result is not close to the edge of the tolerances or permitted variations, the comparator exits the program (block 72). If the result is close to the edge of the tolerances or permitted variations, an invalid counter is incremented by one (block 74). The counter is checked (block 76) and, if the result is less than a pre-selected number, e.g. 5, the comparator exits the program (block 78). If the result equals the pre-selected number, the old signature is replaced by the new signature (block 80), and the Tolerance Table is rebuilt to include the new signature parameters and permitted variations (block 82). At the same time, the Invalid Counter is cleared.

According to another embodiment of the invention, the signature authentication is utilized for network access, instead of a password. In this embodiment, the personal signature profile is provided to the network, in lieu of a personal passwork. When access to the network is desired, the user signs a digitizer coupled to his workstation, and the signature is compared with the personal signature profile. This method greatly increases security within the network, by preventing access to a hacker who discovered the password by unauthorized means, or to an unauthorized person who was given the password.

It will be appreciated that the invention is not limited to what has been described hereinabove merely by way of example. Rather, the invention is limited solely by the claims which follow.

CLAIMS

1. A system for authenticating a signature comprising:

(a) a digitizer and associated electronic pen;

5 (b) a dynamic identification unit for receiving data from said digitizer produced during signature by said electronic pen on said digitizer, calculating signature parameters and permitted variations from said data, and generating a reference signature record therefrom;

10 (c) a comparator for comparing said received parameters produced during signature with said reference signature record; and

(d) apparatus for providing an accept or reject response in accordance with the output of said comparator.

15 2. The system according to claim 1, further comprising:

a transmitter for transmitting said calculated signature parameters for authentication; and

a receiver for receiving said transmitted signature parameters, said receiver being coupled to said comparator.

20

3. The system according to claim 2, wherein:

(a) said system further includes an encryptor for encrypting said measured parameters to provide an encrypted signature record; and

25 (b) said dynamic identification unit further includes a decoder for decoding said encrypted signature record.

4. The system according to claim 1, wherein said reference signature record is stored on an IC (integrated chip) card.

30

5. The system according to any of claims 1 to 3 for authenticating a signature transmitted over a transmission line comprising:

(a) a vendor unit including:

(1) a digitizer and associated electronic pen; and
(b) a signature authorization unit coupled to said vendor unit by the transmission line and including:

5 (1) a dynamic identification unit for receiving data from said digitizer produced during signature by said electronic pen on said digitizer, calculating signature parameters therefrom, and generating a reference signature record corresponding thereto;

10 (2) a comparator for comparing said parameters produced during signature with said reference signature record; and

15 (3) apparatus for providing an accept or reject response to said vendor unit in accordance with the output of said comparator.

15

6. The system according to claim 2 or 3 for authenticating a signature transmitted over communication transmission lines comprising:

(a) a cardholder unit including:

20 (1) a digitizer and associated an electronic pen;

(2) apparatus for transmitting the output of said digitizer over the communication transmission lines;

(b) a signature authorization unit including:

25 (1) a dynamic identification unit for receiving data from said digitizer produced during signature by said electronic pen on said digitizer, calculating signature parameters therefrom, and generating a reference signature record corresponding thereto;

30 (2) a comparator for comparing said parameters produced during signature with said reference signature record; and

(3) apparatus for providing an accept or reject response in accordance with the output of said comparator; and

(c) a vendor unit coupled to said cardholder unit and to said signature authorization unit by the communication transmission lines and including a transceiver for receiving said output of said digitizer from said cardholder unit and 5 transmitting it to said signature authorization unit; and for receiving said accept or reject response from said signature authorization unit.

7. The system according to any of the preceding claims, 10 wherein said reference signature record includes an array of signature parameters and permitted variations.

8. The system according to any of the preceding claims, further comprising means for updating said reference 15 signature record.

9. A method of authenticating a signature including the steps of:

(a) providing a reference signature record;
20 (b) signing with an electronic pen on a digitizer tablet;
(c) calculating signature parameters from data received from said digitizer produced during signature by said electronic pen on said digitizer;
25 (d) comparing said parameters produced during signature with said reference signature record; and
(e) providing an accept or reject response in accordance with results of the comparison.

30 10. The method according to claim 9, and further including the steps of:

(a) encrypting said calculated parameters with a encryption key after said step of calculating; and
35 (b) decrypting said encrypted parameters before comparing said parameters.

11. The method according to claim 9, wherein said step of providing a reference signature record includes:

5 (a) writing the signature on said digitizer several times;

(b) calculating signature parameters for each signature;

(c) calculating permitted variations of said signature parameters; and

10 (d) storing said signature parameters and said permitted variations as a reference signature record.

12. The method according to any of claims 9 to 11, further comprising updating said reference signature record.

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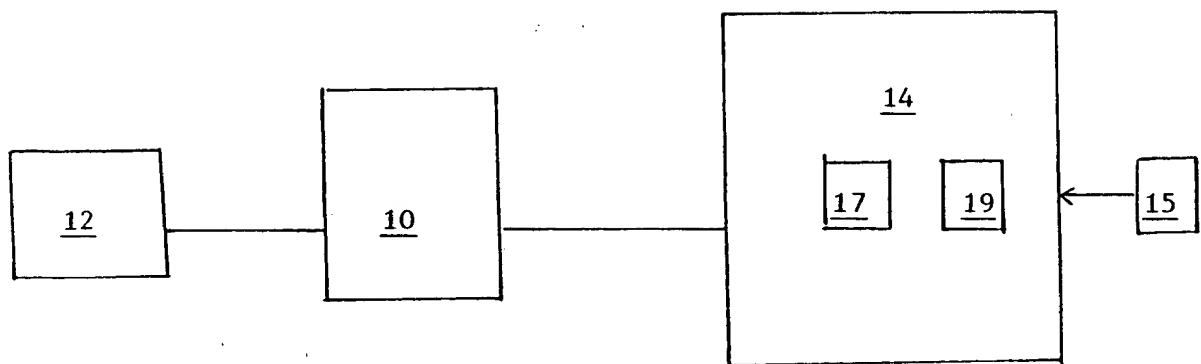


FIG. 1

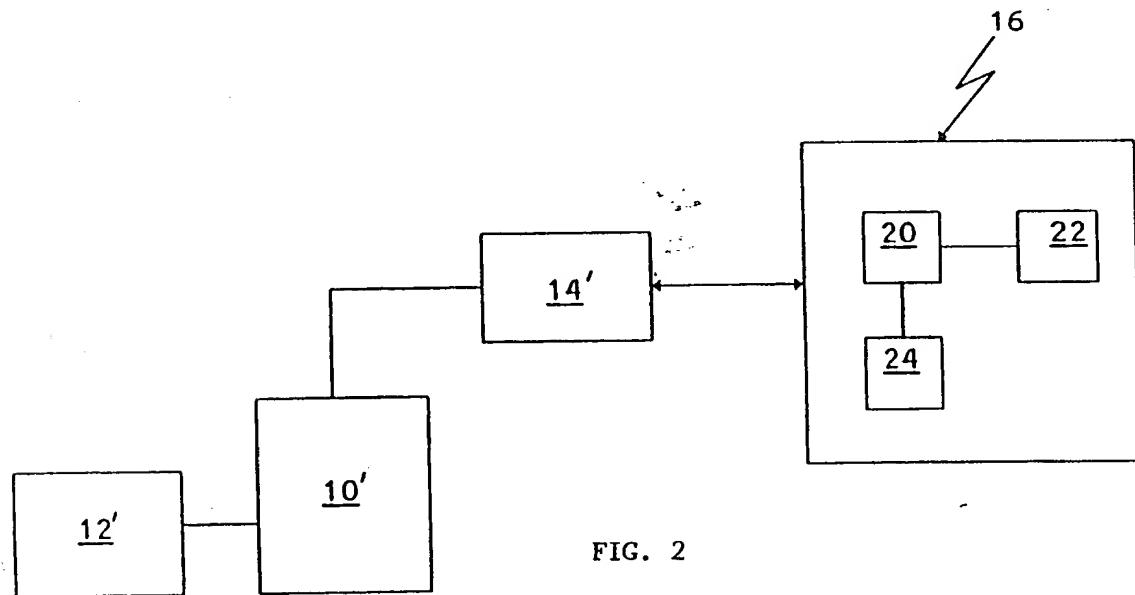


FIG. 2

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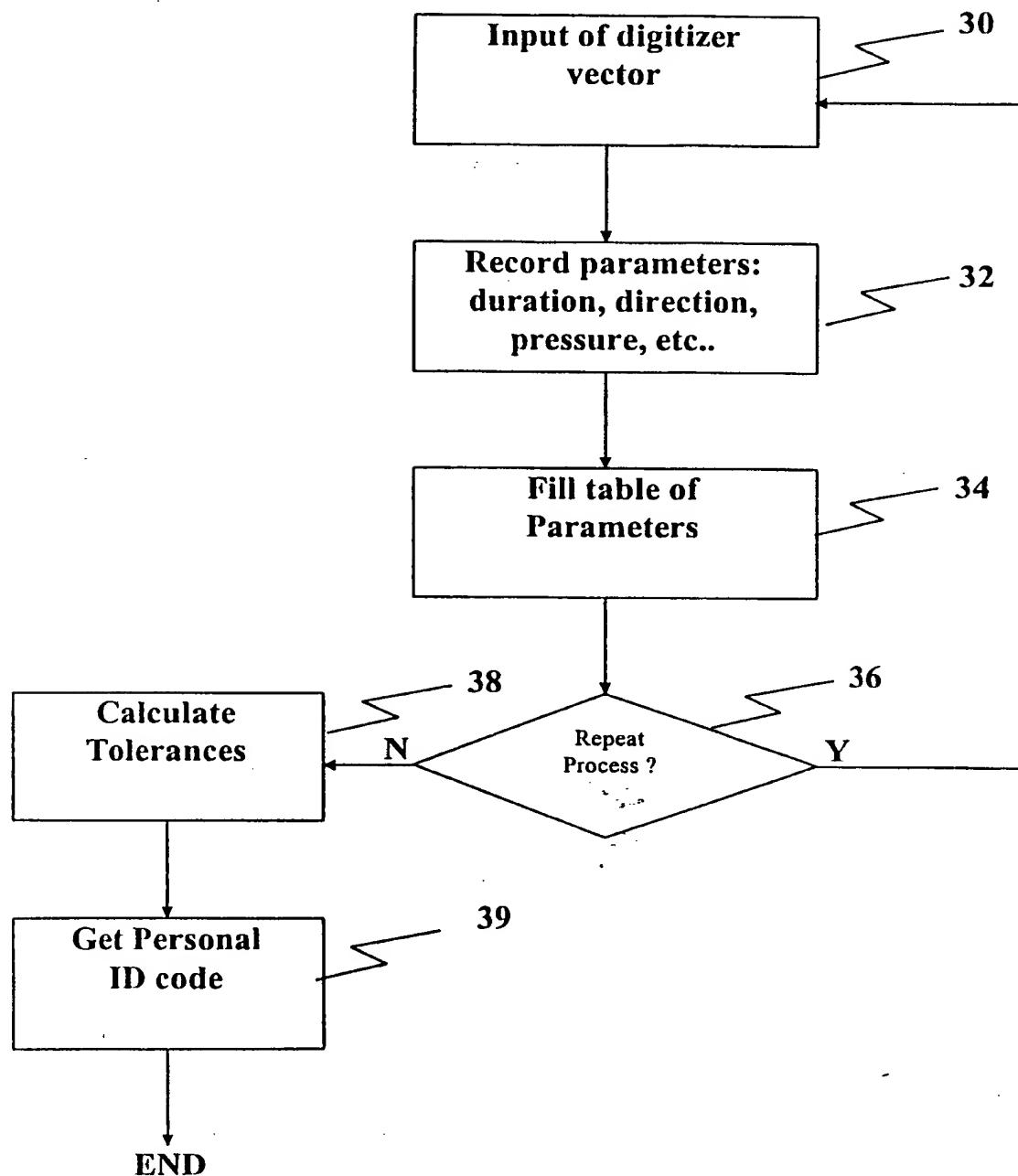


Fig. 3

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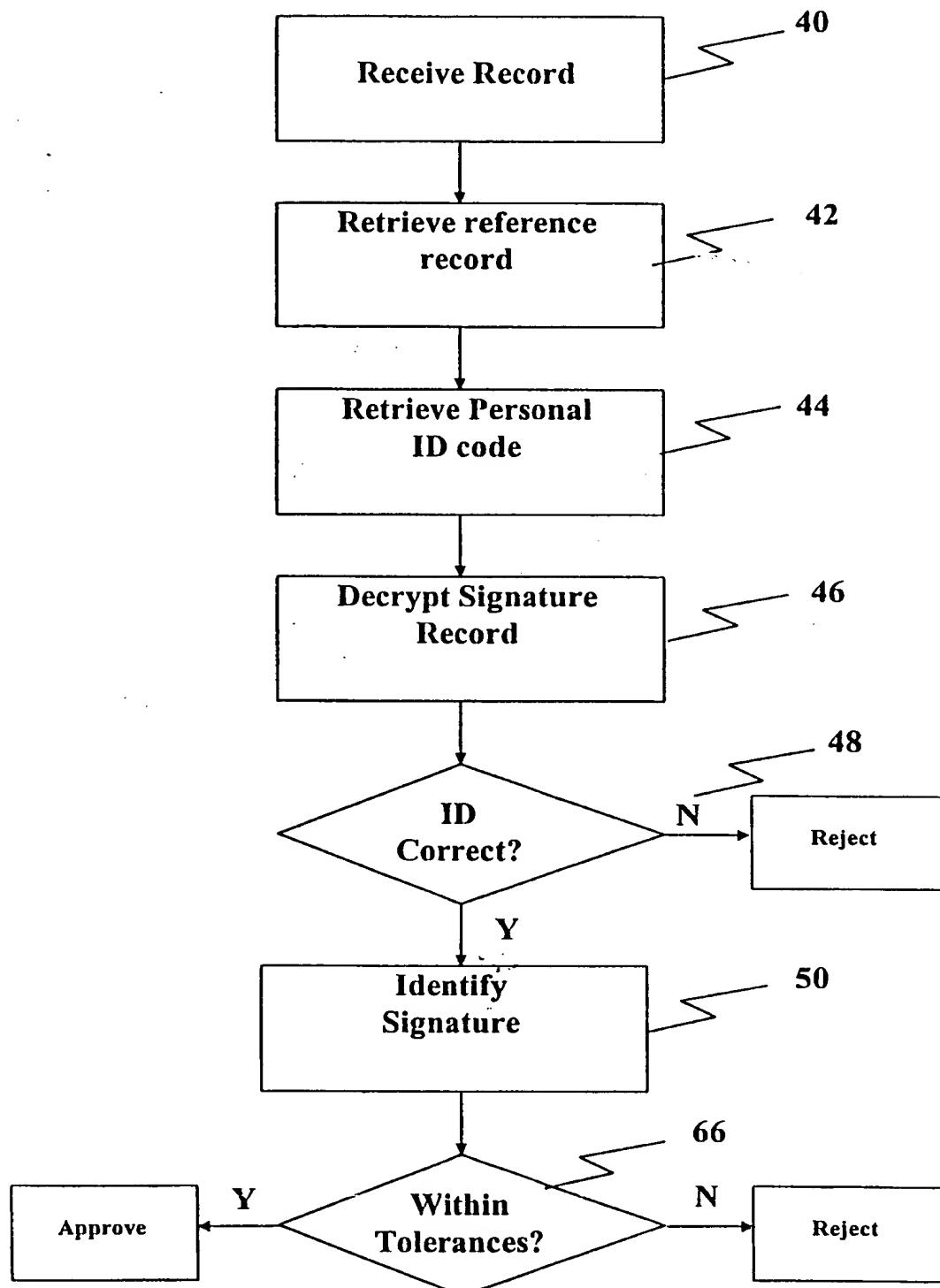
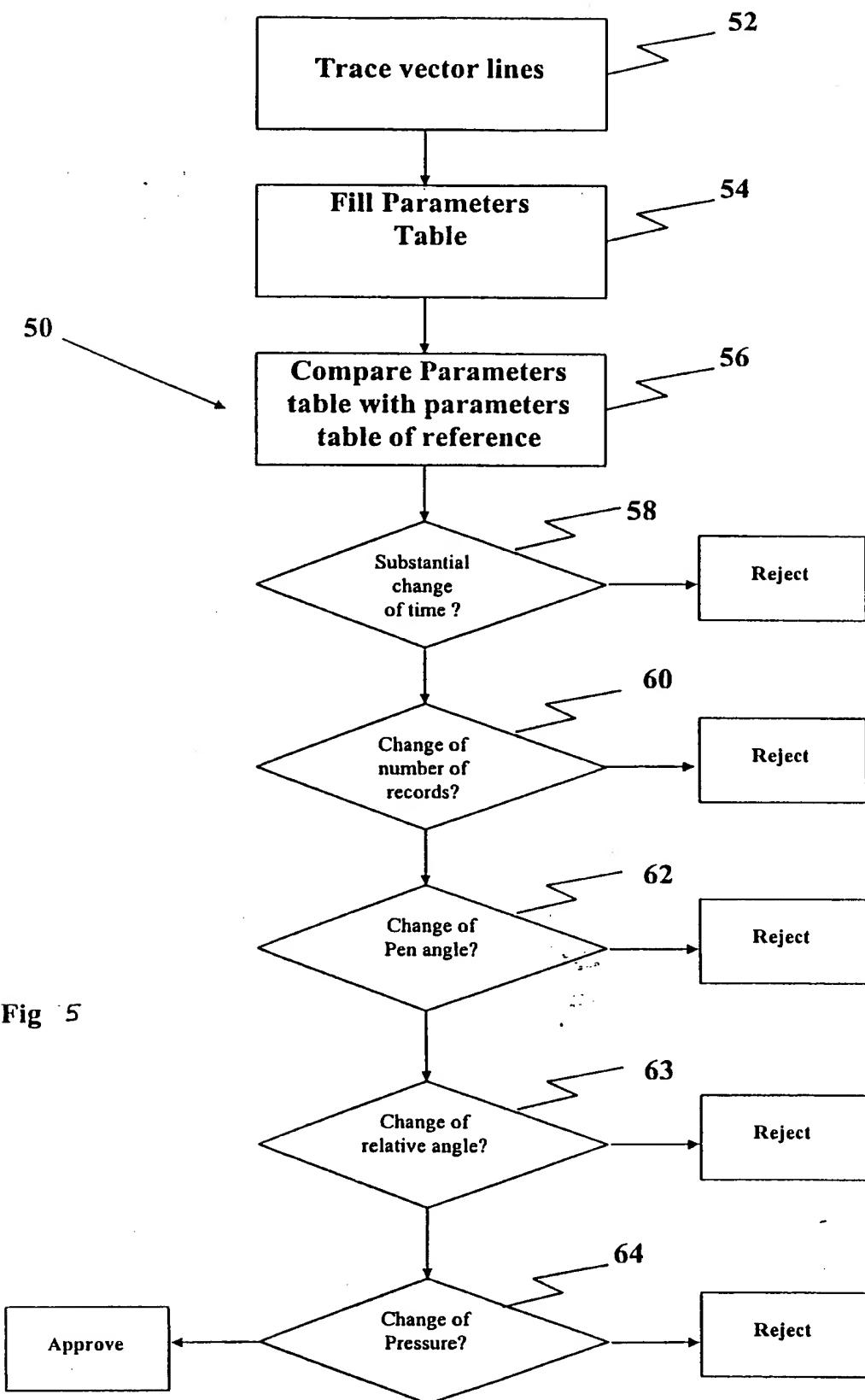


Fig. 4



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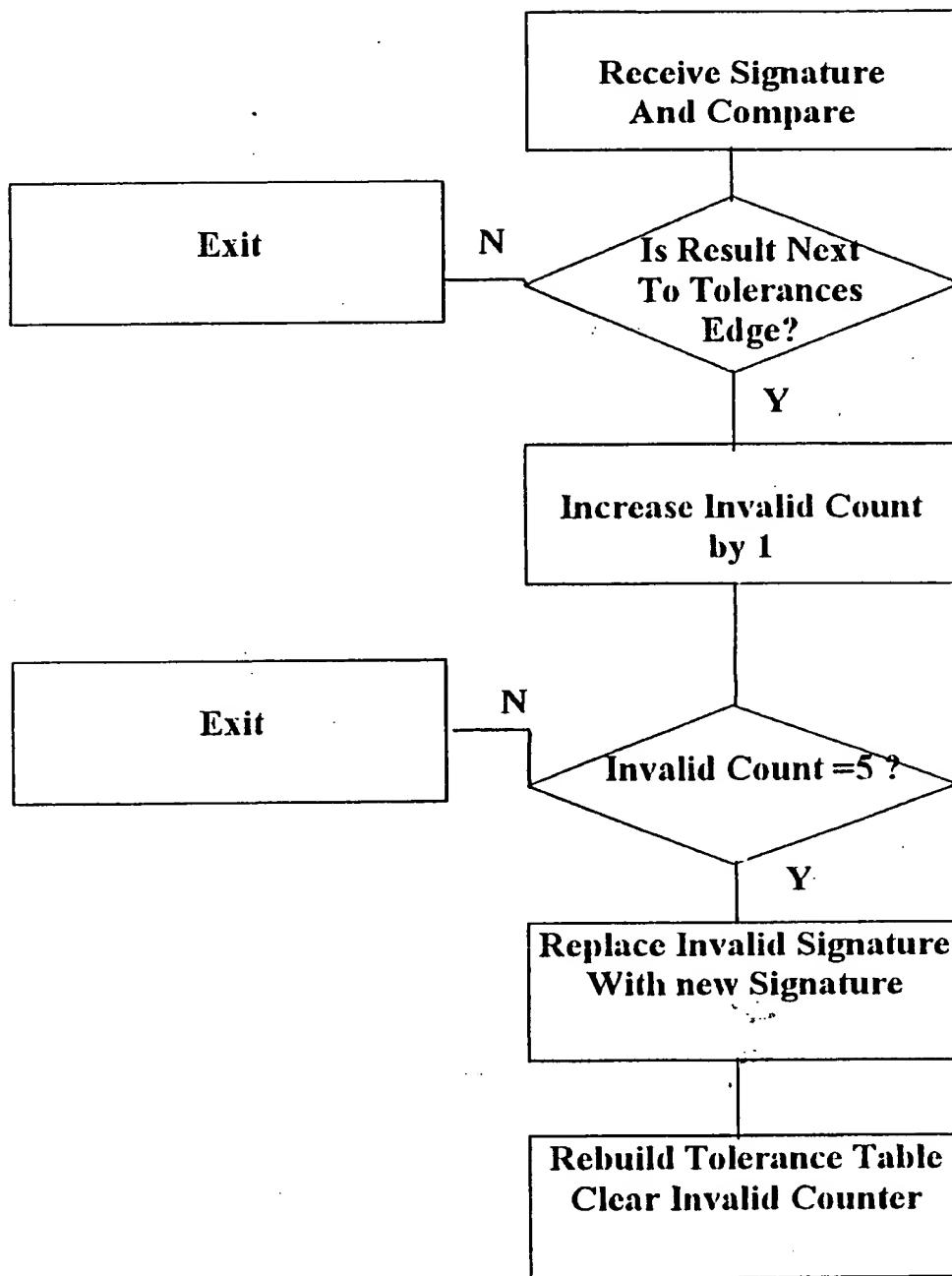


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL98/00342

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04L 9/00

US CL :380/23

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 380/23, 3,25; 382/119

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,150,420 A (HARAGUCHI) 22 September 1992, see entire document, especially Fig. 4.	1-12
Y	US 5,195,133 A (KAPP et al) 16 March 1993, See Fig. 5.	1-12
A	US 5,222,138 A (BALABON et al) 22 June 1993, See Fig. 2.	1-12
Y	US 5,297,202 A (KAPP et al) 22 March 1994, See Fig. 5.	1-12
Y	US 5,434,928 A (WAGNER et al) 18 July 1995, See Figs. 1-10	1-12
Y	US 5,544,255 A (SMITHIES) 06 August 1996, See Fig. 4.	1-12

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	*T*	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance		
E earlier document published on or after the international filing date	*X*	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y*	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
O document referring to an oral disclosure, use, exhibition or other means	*&*	document member of the same patent family
P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
09 OCTOBER 1998	03 NOV 1998
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer SALVATORE CANGIALOSI <i>John Bell</i>
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL98/00342

C (Continuation): DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US 5,699,445 A (WAGNER et al) 16 December 1997, See Fig.1.	1-12